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(71) Applicant 593204214
Mitsubishi Kagaku Foods Corp.
Ginza 1-3-9, Chuo-ku, Tokyo
(71) Applicant 000005968
Mitsubishi Chemical Corp.
Marunouchi 2-5-2, Chiyoda-ku, Tokyo
(72) Inventor Toshiki Takayanagi
c/o Mitsubishi Kagaku Foods Corp., Ginza 1-3-9, Chuo-ku, Tokyo
(74) Representative 100097928
Kazuhiko Okada, Patent Attorney

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(54) [Title of Invention] Spindly growth inhibitor for cell-molded seedlings and method for producing cell-molded seedlings

(57) [Summary]
[Object] To offer a spindly growth inhibitor for cell-molded seedlings that produces plants with above-ground parts that are thick, robust and of short stature, at the same time forming an extensive root ball spreading a large number of thick, robust roots through all of the starting soil. soil.
[Means for solution] An active component of an emulsifier selected from a group of polyhydric alcohol fatty acid esters and lecithins.

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[1] Signifies that the patent application was made online <*translator*>.

[Claims]
[Claim 1] A spindly growth inhibitor for cell-molded seedlings, wherein an active component is an emulsifier selected from a group of polyhydric alcohol fatty acid esters and lecithins.
[Claim 2] A spindly growth inhibitor as recited in Claim 1, wherein the HLB of the emulsifier is 3 or higher.
[Claim 3] A spindly growth inhibitor as recited in either of Claims 1 or 2, wherein the polyhydric alcohol fatty acid ester is one selected from a group of fatty acid esters of sucrose, fatty acid esters of polyglycerin, and fatty acid esters of sorbitol.
[Claim 4] A method for producing cell-molded seedlings, wherein seeding is performed in a cell, and seedlings are grown in the presence of a spindly growth inhibitor as recited in any of Claims 1-3.

[Detailed description of the invention]
[0001]
[Technical field of the invention] The present invention concerns a spindly growth inhibitor for cell-molded seedlings and a method for production of cell-molded seedlings. The spindly growth inhibitor of the present invention possesses the ability to suppress the spindly growth of the above-ground portion of a cell-molded seedling and to create an extensive root ball.

[0002]
[Prior Art] Segregation of seedling raising and cultivation has developed rapidly as one means of labor conservation in agriculture, specifically, a system in which seedlings are raised in large quantity in a mechanized seedling-raising facility, and the grower purchases and cultivates the sprouted seedlings. In this system, standardized trays are used, and homogeneous seedlings are produced on a large scale in a highly mechanized seedling production facility up to a size at which a root ball has formed. This system is termed a seedling production system, and the seedlings thereby produced are generally termed cell-molded seedlings.[2]

[0003] There are important problems in the production of various cell-molded seedlings as described above with a focus on vegetables and flowering ornamentals, such as the prevention of missing plants cultivation of the seedlings in a uniform fashion, reduction of plant damage during transplanting, and improved compatibility with mechanical planting. In particular, so-called spindly growth, a phenomenon wherein the above-ground plant structure weakens and plant stature increases to an extreme level, gives rise to problems such as decreased seedling quality, plant damage during mechanical transplanting, and reduced rooting ability. in Consequently, in order to suppress spindly growth, various conditions must be managed rigorously according to the type of plant, and improvement of transplanting machines and other such measures taken have not been adequate.
[0004] In the case of celery growing, the crown portion is very thick, and the plant must be thinned 4-5 times during this growing period; there are instances of attempts to increase compatibility with mechanized planting, but production by such systems is necessarily quite cumbersome.
[0005]
[Problems to be solved by the invention] The present invention was achieved in light of the foregoing circumstances and has an object of offering a spindly growth inhibitor for cell-molded

[2] Common terminology is "plug seedlings"; however, the Claims specify "cell-molded." -ed.

seedlings that produces plants with above-ground parts that are thick, robust and of short stature, at the same time forming an extensive root ball spreading a large number of thick, robust roots through all of the starting soil. Another object of the present invention is to offer a method for producing cell-molded seedlings in which an above-described spindly growth preventing agent is applied.

[0006]

[Means for solving the problems] The first essential element of the present invention consists in a spindly growth inhibitor for use with cell-molded seedlings, wherein an active component is an emulsifier selected from a group of polyhydric alcohol fatty acid esters and lecithins, and the second essential element of the present invention consists in a method for producing cell-molded seedlings, wherein seeds are planted in cells and seedlings are grown in the presence of the aforementioned spindly growth inhibitor.

[0007] The cell-molded seedlings produced by applying the spindly growth inhibitor pertaining to the present invention will be strengthened in their constitution so as to be able to endure even an environment unfavorable for growth, with respect to water, sunlight, nutrients; will suffer little damage during transplanting, and will have excellent compatibility with mechanical planting.

[0008]

[Mode for implementation of the invention] The present invention is described in detail below. First, the spindly growth inhibitor pertaining to the present invention is described. An active component of the spindly growth inhibitor pertaining to the present invention is an emulsifier selected from a group of polyhydric alcohol fatty acid esters and lecithins. Emulsifiers possess lipophilic groups and hydrophilic groups within a single molecule, and their functional characteristics are generally expressed in terms of an HLB value. From the point of view of efficacy and activity, it is preferable that the spindly growth inhibitor pertaining to the present invention include a hydrophilic emulsifier with an HLB of 3 or higher, rather than an oil-soluble emulsifier with a low HLB.

[0009] The HLB value can be calculated with a formula from an atlas. The formula from an atlas for this calculation is: HLB = 20×(1 - (saponification number)/(neutralization number)) (Emulsifiers for Food Use, 2nd Ed.,[3] Tetsuaki Hidaka, Saiwai Shobo). The saponification number is the number of milligrams potassium hydroxide consumed in hydrolysis of 1g fatty acid ester of a polyhydric alcohol, and the neutralization number is the number of milligrams potassium hydroxide required to neutralize 1g fatty acid component of the fatty acid ester of a polyhydric alcohol. Each of these numbers can be calculated from the structural formula of the fatty acid ester of the polyhydric alcohol, or they can be measured according to a common method used in analysis of fats (e.g., Handbook of Fat and Oil Chemistry;[4] Japanese Oil Chemistry Society,[5] ed.; Maruzen, Inc.).

[0010] Examples of the polyhydric alcohol component of the polyhydric alcohol fatty acid ester include glycerin, polyglycerin, sorbitol, propylene glycol, sucrose, maltitol, xylitol, lacitol, and erythritol. Examples of the fatty acid component include saturated or unsaturated fatty acids or oxy-fatty acids having a carbon number from 6-22. Specific examples include caproic acid, caprylic acid, capric acid, lauric acid, myristic acid, palmitic acid, and stearic acid, and in particular, the esters of saturated fatty acids having a carbon number from 12-16 are preferable.

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[3] Unofficial translation. ed.

[4] Ibid.

[5] Ibid.

[0011] Sucrose fatty acids esters, polyglycerin fatty acid esters, glycerin fatty acid esters, sorbitol fatty acid esters, propylene glycol fatty acid esters, and lecithins are utilized widely in various food products as safe food additives and also have excellent biodegradability. Consequently, an emulsifier selected from among the above is desirable with respect to the ecological effects on the environment. In the case of polyglycerin fatty acid esters, a glycerin component with an average degree of polymerization of 2-20 is desirable. Moreover, from the point of view of efficacy and activity, sucrose fatty acid esters, polyglycerin fatty acid esters, and sorbitol fatty acid esters are preferable.

[0012] As a lecithin, in addition to common soybean lecithin or egg yolk lecithin, it is desirable that the lecithin be one subjected to acid or alkaline hydrolysis, partially decomposed or transformed by enzymes, or otherwise treated to impart hydrophilic properties.Specifically known examples include lyso-derivatives, i.e., lecithins from which 1 fatty acid unit is removed by treatment with phospholipase A or A2 or the like, and lecithins converted to glycerol derivatives by treatment with phospholipase D, and any such lecithin may be used. In particular, a lecithin made hydrophilic by enzymes and containing 50 wt% or more lyso-derivatives is preferable.

[0013] The method for producing cell-molded seedlings pertaining to the present invention is next described. In the production of cell-molded seedlings (nursing), normally each of the cells is planted with a single seed, but in the present invention, a method wherein many seeds are planted and seedlings are arranged by thinning during nursing is acceptable.

[0014] Examples of cell-molded seedlings that are the object of the present invention include seedlings of pansies, violas, impatiens, petunias, geraniums, and other such flowers; and seedlings of tomatoes, eggplants, Chinese cabbages, broccolis, lettuces, and other such vegetables. Furthermore, the present invention can be applied to propagation of grafted seedlings or flowering trees and shrubs.

[0015] The production of cell-molded seedlings pertaining to the present invention can be carried out by: (1) a method using seeds pre-coated with the spindly growth inhibitor, (2) a method of mixing the spindly growth inhibitor into the cultivation soil or the cover soil during seedling raising, (3) a method of watering with an aqueous solution of the spindly growth inhibitor, or (4) a method of applying a fertilizer blended with the spindly growth inhibitor. Therein, a method using the spindly growth inhibitor in powdered form, corresponding to the above-mentioned method (2), is preferred as operationally simple and highly effective. The amount of the spindly growth inhibitor to be combined with the cultivation soil is normally 0.01-20 wt% and is preferably 0.1-10 wt%. In this regard, it is also satisfactory to use soil that has been pre-combined, and moreover, when the amount to be combined is small, a so-called master batch can be prepared and used for uniform mixing.

[0016] Examples of acceptable cultivation soils, without being limiting in any particular way, include soils containing volcanic ash, alluvial soil, and crushed rock. Moreover, soil-less planting media that contain no soil, such as peat moss, vermiculite, bark compost, or perlite, are also satisfactory.

[0017] Cell-molded seedlings can be produced by utilizing trays (coupled pots) containing dozens if not hundreds of cells (openings).Without being limiting in any particular way, a desirable tray configuration should possess the strength to enable repeated cycles of use, and the configuration should make it possible to maintain adequate ventilation from beneath the cells.

Cells with a deep shape are desirable. The amount of air contained within the cells can be increased by adding a quantity of compost.

[0018] After the cells are planted with seed, cover soil is added to the cells, watering is performed, and germination is induced by providing optimum temperature and moisture, with adequate ventilation. Since the optimum temperature and moisture conditions differ for various vegetables and flowers, germination is carried out in a dedicated germination room. In this way, nursing is carried out with management of growth conditions at different growth stages, such as adequate temperature, adequate moisture, day counts, and any illumination needed during germination and the extent thereof.. Generally, when the above-ground portion of the seedlings reaches 2 cm, the cell-molded seedlings are shipped.

[0019] Cell-molded seedlings can be shipped directly in the trays, but packaging is carried out so as to avoid suffocation of seedlings, as well as ejection of seedlings due to vibration during transport. Thus, after receipt, packages should be opened immediately to begin acclimation.

[0020]

[Preferred Embodiments] The present invention is further described in further detail according to preferred embodiments found below, but the present invention, to the extent that the essence thereof is not exceeded, is in no way limited by the following embodiments.. The embodiments below employ seedling-raising cells that are 220 mL-capacity cylindrical plastic containers with a 7cm diameter, 9cm depth, and 5 drainage holes (3mm diameter) in the bottom.

[0021] Preferred Embodiment 1

Starting soil for seedling raising was prepared by blending 2 wt% sucrose stearate ("Ryoto sugar ester", HLB16, Mitsubishi Kagaku Foods, Inc.) with commercial starting soil (varietal planting soil, Akimoto Tensanbutsu, Ltd..) . Next, 50g of the seedling starting soil was added to a seedling growth cell for use as the experimental pot. At the same time, a seedling growth cell was filled with 50g of the commercial soil without added sucrose stearate for use as the control pot.

[0022] For the test seeds, kiwi fruit, daikon, Chinese cabbage, spinach (the above from Atariya Noen) and poppies (Tokyo Kaoen, Ltd.) were used; each of the cells used as the above-noted experimental pots and control pots was sown with approximately 20 seeds; and seeds were covered with soil sufficient for concealment and watered thoroughly.. Each seedling growth cell was placed near an indoor window and was watered twice daily, at morning and evening. Molded seedlings grown 7 days were removed, and the above-ground and below-ground growth was observed. The characteristic differences observed between control pots and test pots among all test plants are noted in Table 1 below.

[0023]

[Table 1]

	Above-ground part	Below-ground part
Control pot	Spindly growth is fragile	Flaccid fine roots poorly distributed in the circumference of the cultivation soil
Test pot	Stocky plants of short stature. Also, robust and greened up.	Thick, robust roots densely distributed in the circumference of the cultivation soil

[0024] Embodiment 2
Broccoli (from Atariya Farms) was used for the test seeds, and other than the different emulsifiers used as shown in Table 2 below, the seedlings were grown in the same manner as in Embodiment 1, and the results of the tests were observed after 7 days. For these observations, a 4-tier rating scale was employed as described in Table 3. The results are shown below in Table 4.

[0025]
(Table 2] <Emulsifier 1> Sucrose stearate ("Ryoto-sugar ester", from Mitsubishi Kagaku Foods, Inc., HLB 1)
<Emulsifier 2> Sucrose stearate ("Ryoto-sugar ester", from Mitsubishi Kagaku Foods, Inc., HLB 5)
<Emulsifier 3> Sucrose stearate ("Ryoto-sugar ester", from Mitsubishi Kagaku Foods, Inc., HLB 16)
<Emulsifier 4> Decaglycerin stearate ("Ryoto-sugar ester", from Mitsubishi Kagaku Foods, Inc., HLB 13; 40 wt% aqueous solution; 2 wt% additive in the mixture calculated on a solid basis)
<Emulsifier 5> Glycerin stearate (Riken Vitamin, Inc. "Emulsi-MS", HLB 4)
<Emulsifier 6> Sorbitol stearate (Peony, Inc.,[6] "Emazol S-10(F)", HLB 5)
<Emulsifier 7> Propylene glycol stearate (Riken Vitamin, Inc., "Rikemul PS-100", HLB 4)
<Emulsifier 8> Soybean lecithin (Nisshin Oil Mills, Ltd., "Lecithin DX")

[0026]
[Table 3] <Above-ground part>
++ : Spindly growth significantly suppressed; thick, short, robust; greened up.
+ : Spindly growth suppressed; relatively thick, short, robust; greened up.
~ : Somewhat spindly, somewhat fragile, relatively tall stature.
– : Spindly, fragile, tall stature.
<Below-ground Part>
++ : thick, robust roots densely distributed throughout the cultivation soil.
+ : Somewhat thick, robust roots, relatively well distributed throughout the cultivation soil.
~ : Roots somewhat flaccid and fine, relatively poorly distributed throughout the cultivation soil.
– : Roots flaccid and fine, poorly distributed throughout the cultivation soil.

[0027]

[6] Name of company is approximate and should be verified with the client if it is important *<translator>*.

[Table 4]

	Above-ground part	Below-ground part
Control pot	–	–
Test pot: Emulsifier 1	~	~
Test pot: Emulsifier 2	+	+
Test pot: Emulsifier 3	++	++
Test pot: Emulsifier 4	+	+
Test pot: Emulsifier 5	+	+
Test pot: Emulsifier 6	++	++
Test pot: Emulsifier 7	~	~
Test pot: Emulsifier 8	~	~

[0028]
[Effect of the Invention] The above-described invention makes it possible to provide small-sized, robust cell-molded seedlings that will suffer little damage during transplanting, and the cell-molded seedlings have excellent compatibility with fixed transplanting machines. Consequently, it is possible to provide purchasers with a steady supply of homogeneous, high quality seedlings at low cost.

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[0010] Examples of the polyhydric alcohol component of the fatty acid ester of the polyhydric alcohol include glycerin, polyglycerin, sorbitol, propylene glycol, sucrose, maltitol, xylitol, lacitol, and erythritol. Examples of the fatty acid component include saturated or unsaturated fatty acids or oxy-fatty acids having a carbon number from 6-22. Concrete examples include caproic acid, caprylic acid, capric acid, lauric acid, myristic acid, palmitic acid, and stearic acid, and in particular, the esters of saturated fatty acids having a carbon number from 12-16 are preferable.